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REMARKS

Claim 18 has been allowed. Claims 4-6, 13 and 14 were indicated as allowable if rewritten to include all base claim limitations. This has been done in new claims presented here. Other new claims depend from new independent claims and are, therefore, also deemed to be allowable. Claim 9 was indicated as allowable if rewritten to overcome a § 112 rejection and to include all base claim limitations - this has been done in new claim 42.

New independent claim 38 incorporates the subject matter indicated as allowable from original claim 13.

The remaining claims have been rejected for various reasons under § 103. These claims have been cancelled. Applicants believe that the new claims presented here define patentable subject matter.

New Claims presented here correspond to the now-canceled claims as follows:

New Claims	Old Claims
22	1 + 13
24	2
25	3
26	4
27	5
28	6
29	7
30	8
31	9
32	10
33	11
34	12
35	15
36	16
37	17
38	20
39	1 + 4
40	5
41	1 + 6
42	1 + 8 + 9

Amendments To specification

The title has been changed as suggested by the Examiner. The text has been updated to specify the status of the parent application. Submitted herewith are pages with replacement paragraphs for the amendments to the specification.

Additional Claims

Enclosed is a PTO Form 2038 authorizing the payment of $ 52.00 for 1 additional claims in excess of 20 claims, and for 1 independent claims in excess of 3 independent claims [taking into account the fees already paid].

Reference Copies

As requested by the Examiner, copies of the non-patent literature listed in the Information Disclosure Statement are enclosed.

Conclusion

Applicants appreciate the careful and detailed Office Action. Applicants note that the drawings have not been rejected. This is intended to be a complete Response to the Office Action. Early and favorable reconsideration is respectfully requested.

Respectfully submitted,

Guy McClung
Reg. No. 29,008

Date: 16 DEC 03

PMB 347
16690 Champion Forest Drive
Spring, TX. 77379--7023
Phone: 713 893 5244

CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8

I hereby certify that this correspondence is being deposited with sufficient postage as first class U.S. mail with the United States Postal Service in an envelope addressed to: Mail Stop Non Fee Amendments; Commissioner for Patents; P.O. Box 1450; Alexandria VA 22313-1450 on 16 DEC 03.

Date: 16 DEC 03

Guy McClung, Reg. No. 29,008

IN THE UNITED STATES PATENT
AND TRADEMARK OFFICE

APPLICATION FOR
UNITED STATES UTILITY PATENT

A METHODS FOR APPLYING WEAR-REDUCING MATERIAL USING A LASER BEAM TO TOOL JOINTS

INVENTORS
JIMMIE BROOKS BOLTON
BILLI MARIE ROGERS

USING A LASER BEAM TO

METHODS FOR APPLYING WEAR-REDUCING MATERIAL TO TOOL JOINTS

RELATED APPLICATION

This is a continuation-in-part of U.S. Ser. No. 09/769,555 filed 1/25/01, incorporated fully herein for all purposes.

issued as U.S. Patent No. 6,428,858 B1 on August 6, 2002

Thermal Spraying

Practice, Theory, and Application

Prepared by
AWS Committee on Thermal Spraying

Under the Direction of
AWS Technical Activities Committee

Approved by
AWS Board of Directors

AMERICAN WELDING SOCIETY, INC.
550 N.W. LeJeune Road
P.O. Box 351040
Miami, Florida 33135

Library of Congress Number: 84-62707
International Standard Book Number: 0-87171-246-6

American Welding Society, 550 N.W. LeJeune Road, P.O. Box 351040, Miami, Florida 33135

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Printed in the United States of America

not detrimental, since porous passages through the thickness will not give rise to substrate attack because of the galvanic protection. The natural surface texture provides an excellent base for sealers or paint top coats.

There is a history of corrosion protection by metal spraying for structural steel work. Included are buildings, bridges, towers, radio and TV antenna masts, steel gantry structures, high power search radar aerials, overhead walkways, railroad overhead line support columns, electrification masts, tower cranes, traffic island posts, and street and bridge railings. On a smaller scale, zinc spraying has been used successfully to protect outdoor wrought iron furniture in corrosive environments.

The sulphurous and oxidizing atmospheres of chemical industries provide many applications, including storage tanks for fuels, alcohol, acetate, toluene, glycerine, molasses, and pump sleeves, mechanical seals, and impellers. Parts subjected to severe chemically corrosive environments require testing and evaluation of the coating before being placed in service.

Wellhead assemblies, for offshore use, have been coated for salt atmosphere corrosion protection since the 1950's. The process has been used for flare stacks, refinery columns, and for external protection of oil and propane gas storage tanks.

The interiors of fluid cargo railcars are thermal sprayed to control fluid purity and guard against iron contamination. The coating also aids in avoiding the discoloration of the cargo. Steel railroad cars are zinc sprayed for corrosion protection. These coatings should last the lifetime of the cars, thus eliminating the need of removal from service for painting (approximately every five years).

Spraying has been used to protect pipelines against many other environments. Lengths up to 40 feet (12 m) have been successfully coated internally. Pipe couplings, manhole covers, and other small industrial items are coated. Zinc spraying can restore corrosion protection to areas of products where galvanizing is inadvertently removed during fabrication. This can occur on the threaded ends of electrical conduit, or along the welded seams inside galvanized barrels and drums. Here, spraying is particularly advantageous because it ensures uniformity and reproducibility of coating thickness.

Sprayed zinc coatings have protected fresh water pipelines, the interiors of water towers, and sluice and canal lock gates in irrigation systems. These coated components have required virtually no maintenance for decades.

Sealed zinc coatings improve the resistance to corrosion of steel bridgework and railings from de-icing salts. Furthermore, the rebars in reinforced concrete can be zinc sprayed to retard corrosion. Reinforced concrete bridges and highways, especially in marine environments, commonly suffer damage caused by road salting (de-icing). There is evidence that the rate of corrosion of the reinforcing steel is substantially reduced if the steel is coated with zinc prior to embedding in the concrete.

In marine applications, hulls, deck sections, and concrete portions of barge, scow, tug, and fishing vessel superstructures have been sprayed with excellent long term results. Lifeboats and floating caissons have also been coated, as well as smaller items such as ship rudders and the axles of boat trailers. A common usage of metal spray is on piers, pilings, and ferry berths.

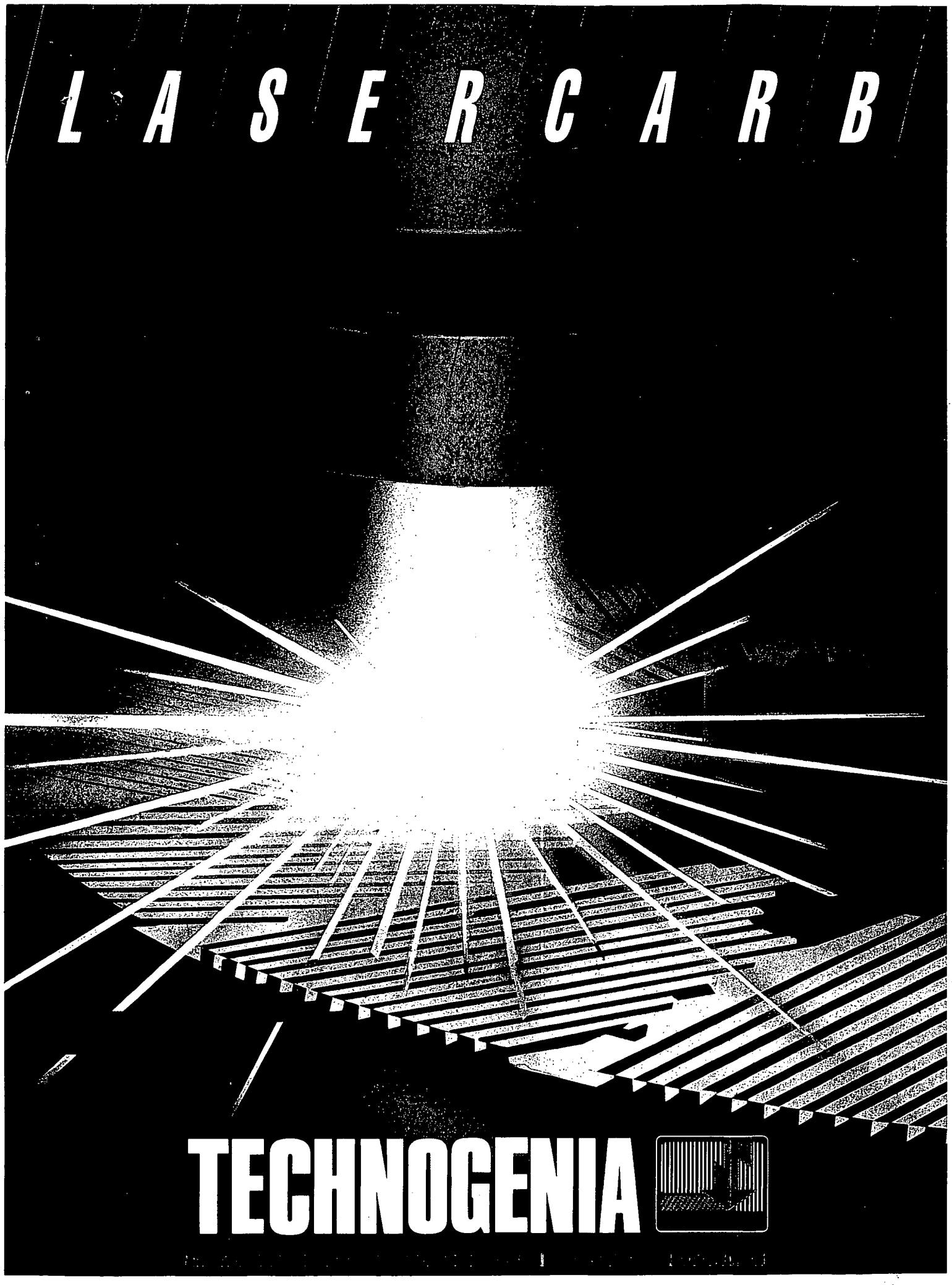
The U. S. Navy, in a major effort to combat shipboard corrosion, has developed a comprehensive program of thermal spray metallization. A number of above deck and steam room ferrous metal components have been sprayed with aluminum and subsequently sealed. Tests to date are encouraging and have led the Navy to introduce specifications for a wide range of thermal spray applications.

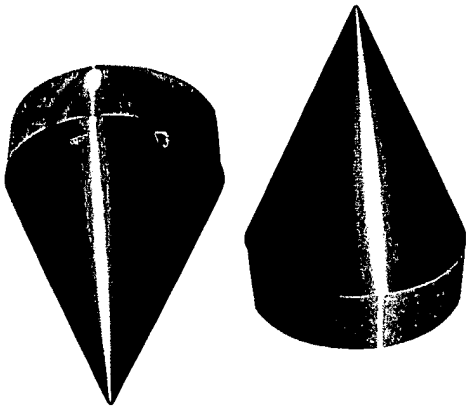
5.8 Decorative Coatings

Thermal spraying has not been widely adapted for decorative coatings. The most common and notable decorative effect occurs when bridges, water towers, masts, chimneys, above ground pipes, and other large structures are sprayed with aluminum or zinc for corrosion protection. Such structures are left unsealed or are clear sealed without further surface treatment. Zinc and aluminum are used for corrosion protection, but they also provide a cosmetic, improved appearance.

Plain and colored sealers, available for corrosion protection, add an aesthetically pleasing appearance to coated structures. For these applications, a choice is made based on economical and practical values. It must be decided whether to apply thin coatings of painting or sealing, or to apply a thick unpainted coating. An example would be: a fresh water tank sprayed internally with a 0.010 in. (0.25 mm) coating of zinc with no subsequent treatment; the exterior sprayed with a 0.004 in. (0.10 mm) coating of zinc that is sealed with aluminum vinyl.

Some work has been done in thermal spraying concrete brick and block products with glazing materials for decorative value. In many applications, thermal spraying has replaced hard or industrial type chromium plating. However, it cannot compete with decorative chromium plating whose primary function is aesthetic appeal.


LASERCARD
TECHNOGENIA



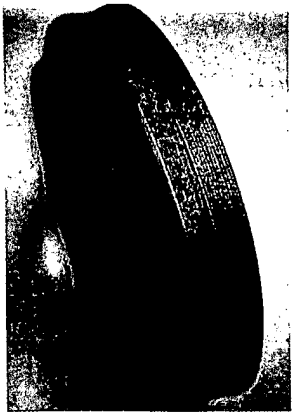
LASERCARB

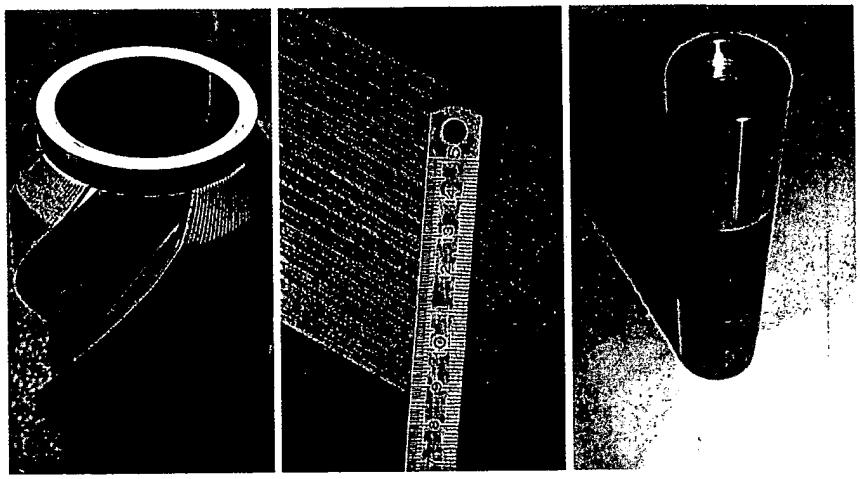
A Laser hard facing process developed by

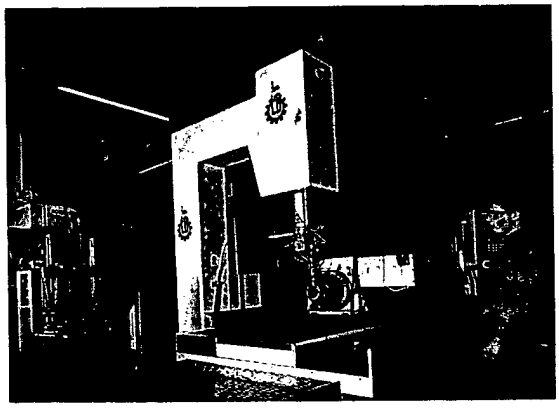
TECHNOGENIA®

TECHNOGENIA®'s R & D Departement has developed a new process for hard facing parts subject to wear.

This process, known as **LASERCARB,** uses energy from a laser beam to surface parts exposed to abrasion.







THE LASERCARB HARD FACING PROCESS

A continuous **CO2 laser**, with an output of **5 kW**, generates a beam, the energy of which is used to melt the surface of the parent metal and also the powdered filler metal.
A special coaxial nozzle supplies the powder and a 4 axis CNC machine is used to apply precise reproducible coatings on parts which are moved in relation to the laser beam. Complete surface coverage is obtained by partial overlapping of the beads.

TECHNOGENIA® produces its own cast **tungsten carbide powders** which are **very pure** and **very hard** (3000 to 4000 HV). These powders, spherical or crushed to suit different applications, alloyed with nickel-based metal powders which serve as a matrix, provide surfaces with excellent abrasion and erosion resistance and also very good corrosion resistance.

THE ADVANTAGES OF THE LASERCARB PROCESS

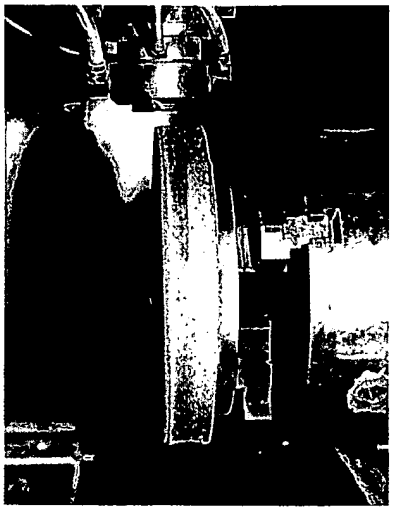
Coatings obtained by laser are metallurgically bonded to the parent metal and are 100 % dense (i.e. non-porous). The **LASERCARB** process thus eliminates the problems of scaling and non-adherence typical of plasma surfacing techniques.

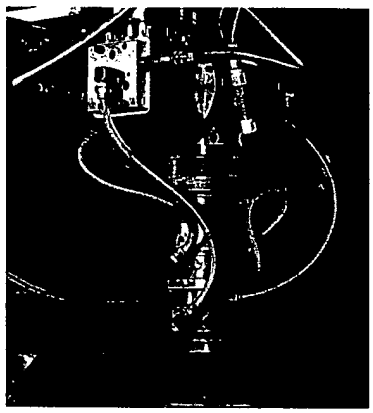
LASERCARB eliminates all cracking in coatings.

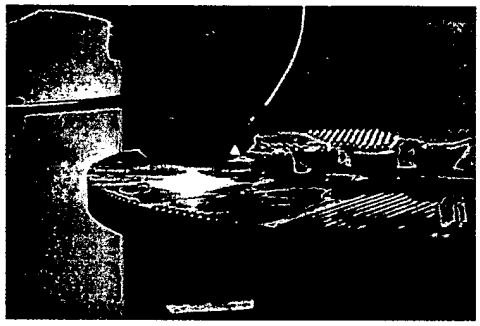
The very precise control of the energy imparted to the parent metal in the **LASERCARB** process produces dilutions of less than 1% of the parent metal in the coating and minimizes or even eliminates any distortion.

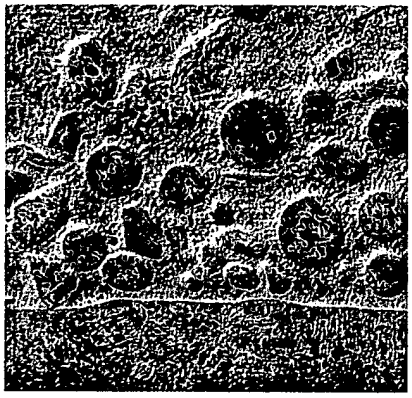
The fine metallurgical micro-structures created by the rapid cooling in the **LASERCARB** process make the metal matrix become very hard.

The **LASERCARB** process does not affect the carbide beads which retain all their intrinsic properties, in particular their extreme hardness and thus give the surface resistance to abrasion.









The CNC programmes and controllers used produce coatings which are perfectly reproducible at any time and of an exactly controlled final thickness. This means that large quantities of identical parts can be processed this way.

THE TECHNOGENIA® SERVICE WITH LASERCARB

Fifteen years of acknowledged experience in the field of hard facing.

Reputable cast tungsten carbide hard facing products.

Unequaled precision of **LASERCARB** surfacing.

Reproducible coatings by means of laser equipment associated with 4-axis numerical control :

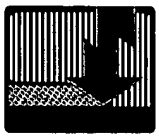
- X-Y table travel : 47" x 24", (1200x600 mm)
- CNC rotating axis, manually tiltable from 0° to 90°.
- maximum permissible load : 2200 pounds (one ton).

Possibility to grind surfaced parts to the required final dimensions.

Extended useful life of Wear parts after **LASERCARB** treatment.

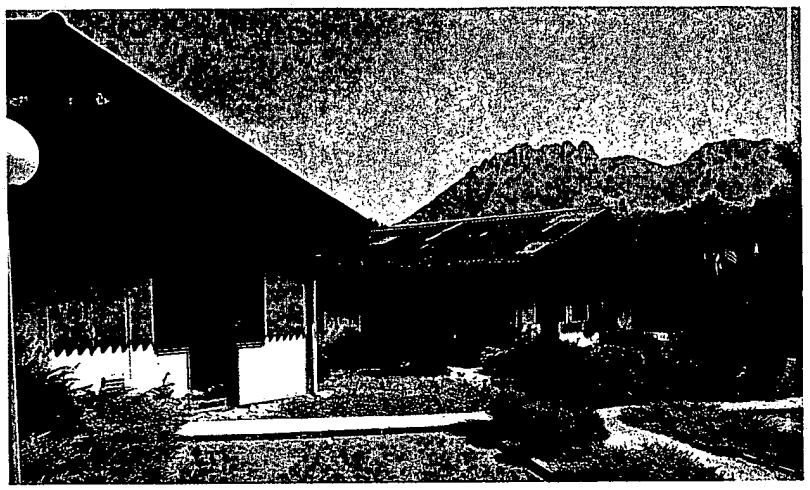
Other types of powder (cobalt or iron-based, etc.) available.

Competitive processing costs and quick delivery times to meet production schedules.

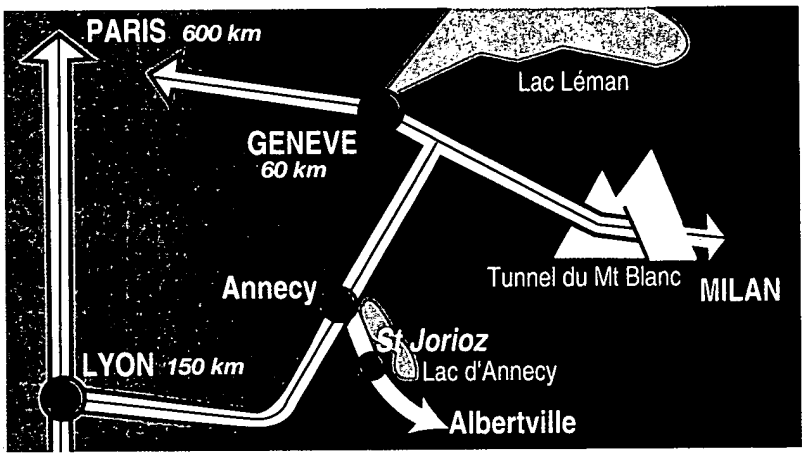


APPLICATIONS FOR THE LASERCARB PROCESS

- **Petroleum Industry**
- **C ramic and Related Industries** : conveyor auger thread edges, scrapers, blades, moulds, valve seats, plugs, etc.
- **Plastics T chnology** : extrusion and injection auger thread edges.
- **Pap r Industry** : refiner discs, pulp machine bottom plates.
- **Pow r Generation** : valve seats and needles.
- **M tals** : cylinders, rings, rollers, etc.



TECHNOGENIA



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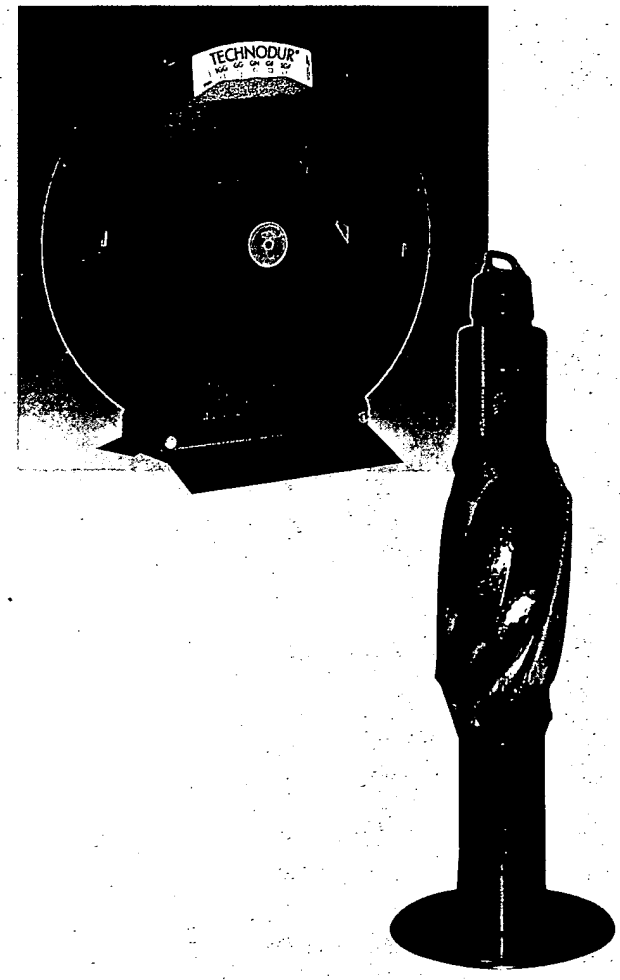
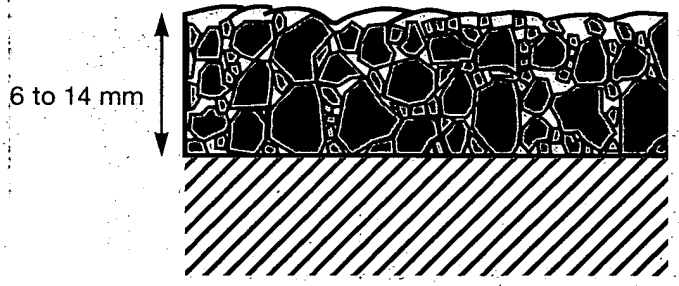
PRIME ALLOYS, INC.
7070 West 43rd Suite 200
Houston TX 77092-4444
Ph 713 939 1500 - Fax 713 939 1997
Roy Cantwell Jim Bolton

HIGH PERFORMANCE TUNGSTEN-CARBIDE BASED HARDFACING





Hardness of carbides 1800/2200HV

TECHNODUR® TGG

Flexible length on reels for Oxy-acetylene welding
6 to 14 mm thick coatings

Main Application

Oil drilling stabilizers.
The manufacturers of drilling equipment find that TECHNODUR®TGG has the required qualities for ensuring the reliability of their equipment.
Exceptional resistance to abrasion, resistance to impacts, ease of repair, absence of cracking.

Description

TECHNODUR®TGG is a flexible length made of a small diameter nickel core wire with a thick coating.
The coating contains a specially formulated matrix of molten tungsten-carbide particles, blended with a high nickel content alloy.

Characteristics and Properties

1° Tungsten-carbides :
The hardfacing coatings are made with a mixture of tungsten-carbide particles of different sizes.
With TECHNODUR®TGG, the main dimension of the majority of the particles lies between is 1.2 and 2.4 mm, with a proportion of secondary particles graded to obtain a compound that is as compact as possible.

2° Bonding Alloy :
Nickel alloy
Hardness : 40-44 HRC

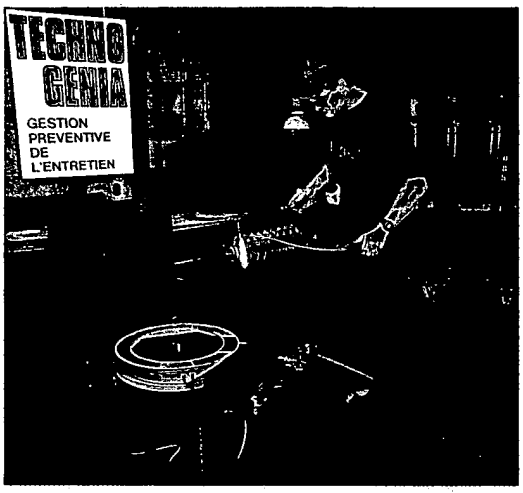
3° Average Expansion Co-efficient :
6 to 7 10-6 cm/cm/°C (estimated)

4° Coating Density :
13,6 g/cm^3

5° Tungsten-carbide Concentration :
The tungsten-carbide concentration depends upon the space left free by the arrangement of tungsten-carbide particles. It is possible to reduce this space by an appropriate grading of tungsten-carbide. In the course of welding the particles are deposited in a relatively compact arrangement. The excess brazing alloy used to prevent oxidisation during welding rises to the surface of the coating, giving it a smooth finish. That is evidence of proper welding and of optimum particle arrangement.

TECHNOGENIA
WEAR PROTECTIONS

HIGH PERFORMANCE TUNGSTEN-CARBIDE BASED HARDFACING



TECHNODUR®TGG provides an optimised concentration of approximately :

$$\frac{\text{Carbide weight}}{\text{Carbide weight + Alloy}} \times 100 = 68$$

6° Chemical Resistanc :
No corrosion has been recorded, even at high temperatures.

Other Typical Applications

- Mixer blades
  (ceramic and chemical industries, concrete etc.)
- Armouring (ceramics industry)
- Augers
- Sugar cane mill ribbed cylinders

Application

TECHNODUR®TGG is applied with an oxyacetylene torch. We recommend the use of the Techno 2000 torch, which is simple to use and easy to maintain.
For volume applications, the FD 2000 automatic device increases the hourly coating rate by 20% to 30%, with a corresponding reduction in consumption of welding gas.
It is recommended to spray MB 40 powder over the work surface prior to applying TECHNODUR®TGG (using the Techno 2000 torch).
The surface to be coated should be ground befor hardfacing.
Successive layers of TECHNODUR®TGG can easily be welded upon each other.

20 kg coils
Diameters : 6 and 8 mm.

TECHNOGENIA

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T´l : (33) 04 50 68 56 60
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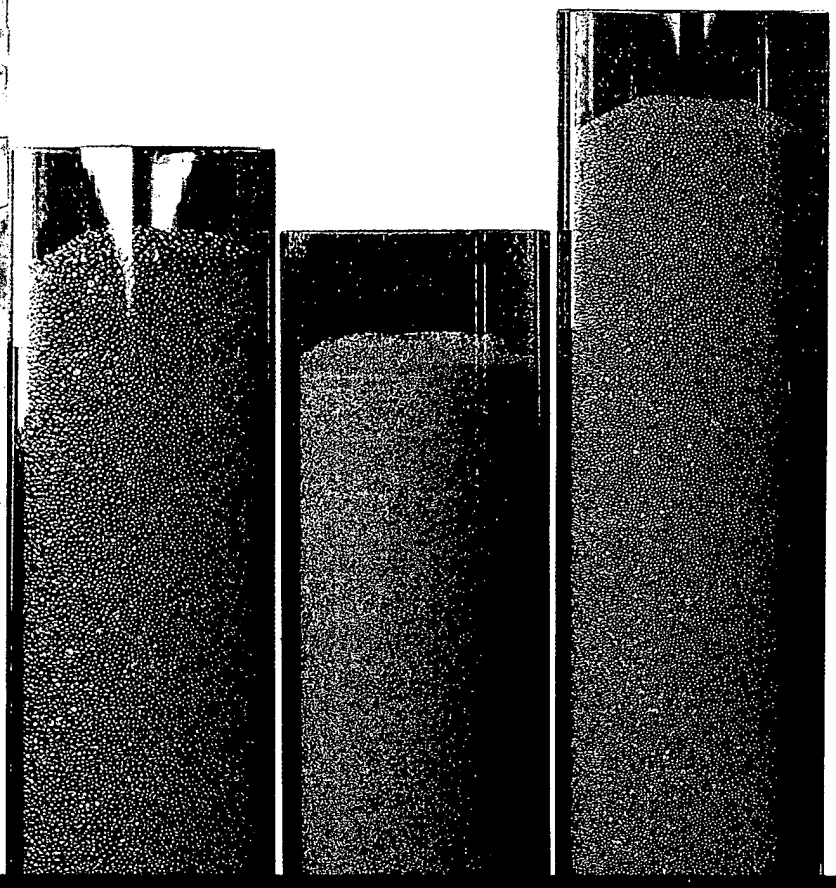
HARD FACING

SPHEROTENE®

TECHNOGENIA'S unique spherical cast tungsten carbides open a new era in the manufacture of composite hardfacing consumables.



PRIME ALLOYS, INC.
7070 West 43rd Suite 200
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Roy Cantwell Jim Bolton

TECHNOGENIA

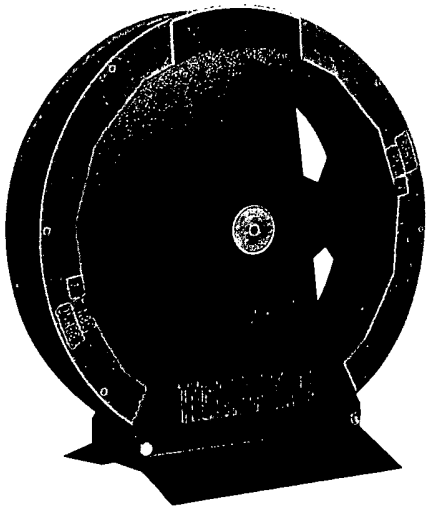
TECHNOGENIA HARDFACING CONSUMABLES

a wide range of industrial uses

Since 1986, TECHNOGENIA has manufactured pure cast tungsten carbide in spherical form. The product of this proprietary process is SPHEROTENE®.

The SPHEROTENE® granules have superior hardness, ranging between 3000 and 4000 Vickers. They are characterized by their extremely fine microstructure.

The unique SPHEROTENE® granules enable TECHNOGENIA to manufacture the world's best hardfacing consumable, TECHNOSPHERE®.



TECHNOSPHERE®

The SPHEROTENE® granules make TECHNOSPHERE® the unchallenged composite material for hardfacing. TECHNOSPHERE® is a flexible composite rod, or *rope*, spooled on reels of 44 pounds. It has a proven track record of more than 10 years for the protection of oil-drilling equipment world-wide.

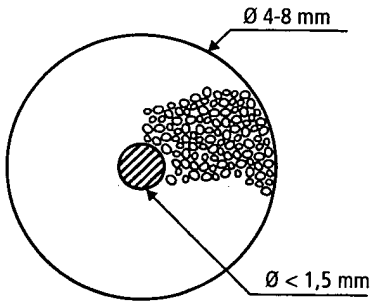
LASERCARB® PROCESS

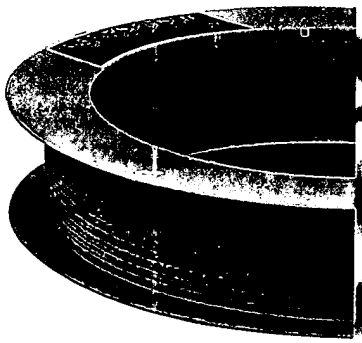
TECHNOGENIA was the pioneer company in developing the process for tungsten carbide laser cladding, a technology we call LASERCARB®. This is the hardfacing of the New Millennium. SPHEROTENE® is the key material in the proprietary LASERCARB® process.

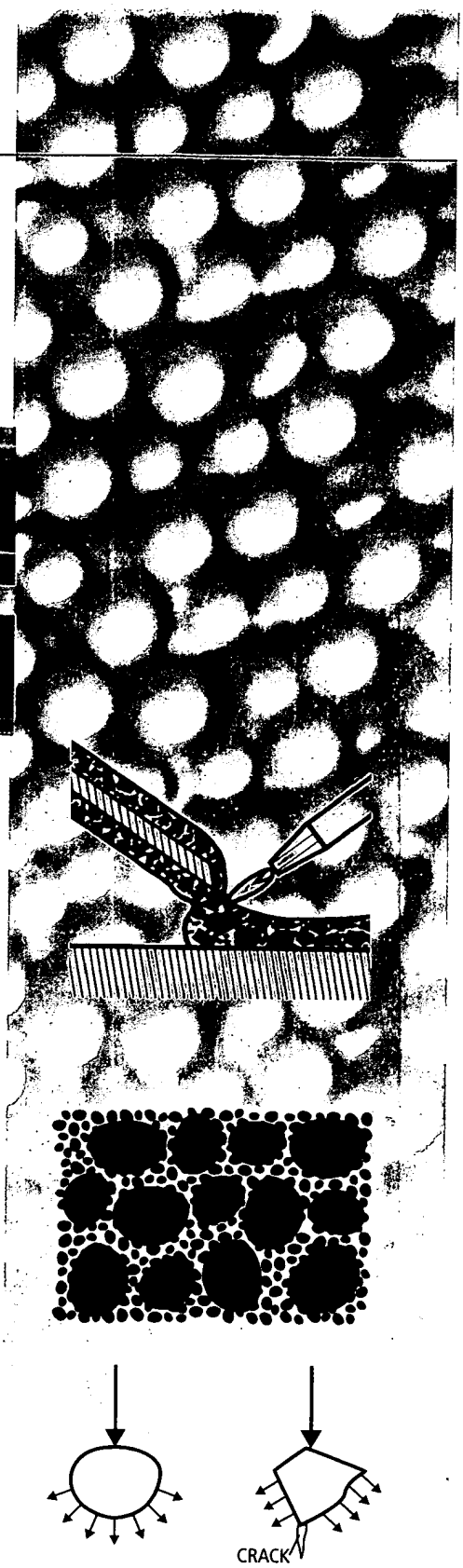
TECHNOGENIA

TECHNOSPHERE®

TECHNOSPHERE® is a unique flexible rod designed for the deposition of a composite hardfacing material.







It is applied with a simple oxyacetylene torch that deposits a tough layer of SPHEROTENE® granules mixed with a nickel-chromium alloy.

The oxyacetylene torch allows application without destruction of the tungsten carbide, as in an arc process.

Deposition rate is high, ranging between 4 and 5 pounds an hour.

TECHNOSPHERE® has outstanding resistance to abrasion and erosion for 3 important reasons :

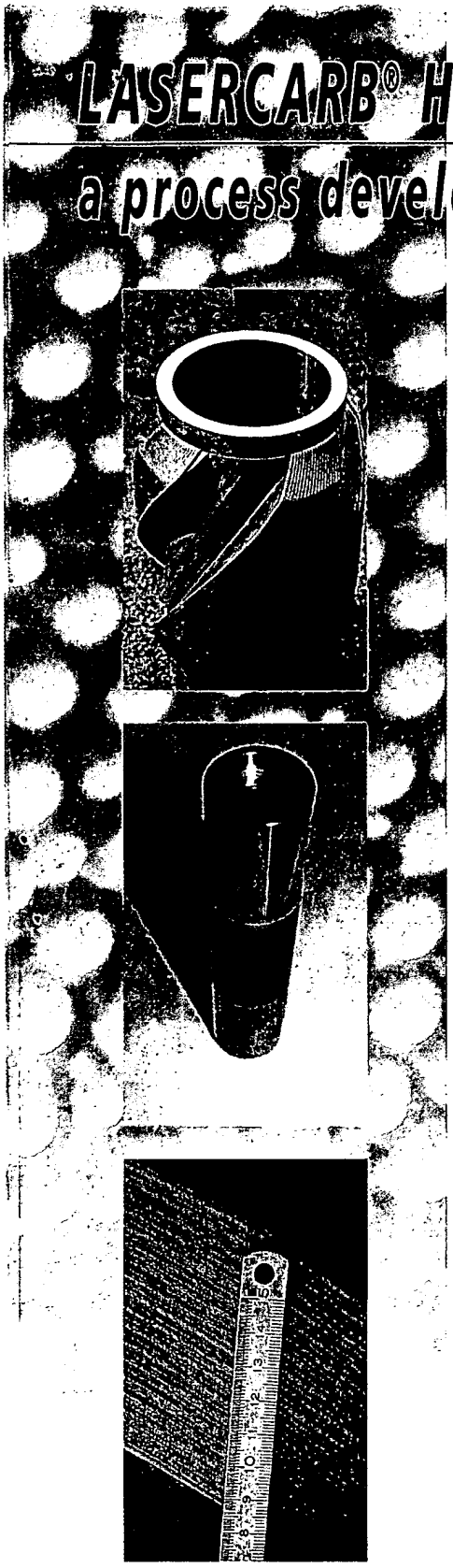
1 - The round particles provide a very compact assembly.

2 - The SPHEROTENE® granules are remarkably hard.

3 - The *round* particles offer improved shock resistance in comparison with a composite hardfacing that consists of *angular* particles of common cast tungsten carbide which give cracks.

LASERCARB® HARDFACING

a process developed by Technogenia



TECHNOGENIA®'s R & D Departement has developed a new process for hard facing parts subject to wear.
This process, known as **LASERCARB®,** uses energy from a laser beam to coat parts exposed to abrasion.

THE LASERCARB HARD FACING PROCESS

A continuous **CO2 laser**, with an output of **5 kW**, generates a beam, the energy of which is used to melt the powdered filler metal.

A special coaxial nozzle supplies the powder and a 4-axis CNC machine is used to apply precise reproducible coatings on parts which are moved in relation to the laser beam. Complete surface coverage is obtained by partial overlapping of the beads.

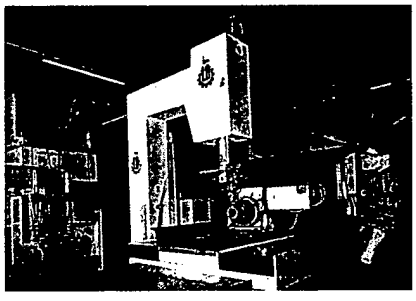
TECHNOGENIA® produces its own cast **tungsten carbide powders Spherotène®** which are **very pure** and **very hard** (3000 to 4000 HV). These powders, spherical or crushed to suit different applications, alloyed with nickel-based metal powders which serve as a matrix, provide surfaces with excellent abrasion and erosion resistance and also very good corrosion resistance.

THE ADVANTAGES OF THE LASERCARB PROCESS

Coatings obtained by laser are metallurgically bonded to the parent metal and are 100 % dense (i.e. non-porous). The **LASERCARB** process thus eliminates the problems of scaling and non-adherence typical of plasma surfacing techniques.

LASERCARB eliminates all cracking in coatings.

The very precise control of the energy imparted to the parent metal in the **LASERCARB** process produces dilutions of less than 1 % of the parent metal in the coating and minimizes or even eliminates any distortion.



The **LASERCARB** process does not affect the carbide beads. They retain all their intrinsic properties, in particular their extreme hardness and thus give the surface resistance to abrasion.

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TECHNOGENIA
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